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Unhealthy lifestyle practices and medical-care costs in the military

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THESIS

UNHEALTHY LIFESTYLE PRACTICES
AND MEDICAL-CARE COSTS IN THE MILITARY

by

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ABSTRACT

The majority of all medical illnesses, and associated costs, can be prevented through personal decisions not to use unhealthy lifestyle practices (e.g., smoking, not exercising). A statistical analysis was conducted to examine whether there was a cost impact on medical care as a result of military personnel engaging in unhealthy lifestyle practices. The approach taken for this analysis used the *1992 Worldwide Survey of Substance Abuse and Health Behaviors of Military Personnel* data base, and the Department of Defense (DoD) contractor's statistical methodology and software tools. Results concluded that specific unhealthy lifestyle practices, used by fit-for-duty military personnel, do impose a modest incremental cost for several site-specific medical services. These findings established the first reference points for DoD to use in monitoring fluctuations in site-specific medical services associated with unhealthy lifestyle practices among the active-duty force. Further research is recommended to study the effects of unhealthy lifestyle practices on medical-care costs in an active duty military cohort, a retired military population under 65, and a retired military population over 65. The results from these studies will allow an examination of the long-term health, utilization, and cost effects of using an unhealthy lifestyle practice.

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I. INTRODUCTION

Health-care expenditures continue to rise at dramatic rates, and will continue to do so until worthy cost-containment measures are implemented. Examples of these rising expenditures can be seen in both the public and private sectors.

- NATIONAL LEVEL: Health care expenditures have risen over 250 percent in the last thirty years and are expected to reach 15 percent of the nation's gross domestic product at the end of 1994 [Ref. 1][Ref. 2].
- DEPARTMENT OF DEFENSE: Health care costs have more than doubled since 1983 [Ref. 3].
- STATE LEVEL: Reflecting the rise at the national level, states' expenditures in health care are now, on average, greater than their expenditures on education [Ref. 4].
- CORPORATE: Rising expenditures now account for "40% to 60% of business spending as a percent of corporate profits [Ref. 5]."

The reasons for these rising expenditures may include an aging population, increased use of health-care services, increase in administration cost, and an increase in malpractice suits and defensive medicine, to name a few [Ref. 6][Ref. 7]. While much attention is focused towards these reasons, the Congressional Budget Office (CBO) suggests that these factors do "not contribute(ed) in a major way to the sharp increases in U.S. health care costs." Rather, the

CBO suggests that the development and use of new and expensive technologies and the growing use of third-party payers (health insurers) contribute to the rising health-care expenditures.

Regardless of where the blame is being placed, health-care expenditures continue to rise. Additionally, there has been little in the way of developments to contain these costs [Ref. 8].

However, with a renewed sense of vigor towards health care reform, health-care costs are being assaulted at the national and state levels, within the Department of Defense (DoD), and within the private sector. In attempts to halt these rising costs, two basic approaches can be taken. The first, a supply-side strategy, focuses on the containment of costs associated with providing medical care by improving the efficiency and effectiveness of how health care is delivered and financed. The second, a demand-side strategy, focuses on containing those medical costs associated with personal decisions made by the demander of medical care: the patient.

This thesis will focus primarily on the demand-side strategy: specifically, the medical-care costs associated with personal decisions to use "unhealthy" lifestyle practices (ULSPs) (e.g., smoking, drinking, lack of exercise).

A. PROBLEM

> If there were no illness and no accidents, health care costs for a society would theoretically be zero [Ref. 9].

The impossibility of no illness and no accidents in our society is just that: impossible. However, national statistics have documented that at least 70 percent of all illnesses and associated costs are preventable by the patients themselves, and the health practices they use [Ref. 10]. A demonstration of this statistic is shown by the large number of people, 7 million in the United States, who are afflicted with preventable coronary heart disease. And, because of this disease over 284,000 bypass procedures are performed each year, costing an average of $30,000 each [Ref. 11]. The importance of these statistics suggests that the demander of medical care, the patient, can play a critical role in controlling medical-care cost and utilization through his or her own lifestyle decisions.

While much is known on how to avoid preventable diseases, through healthy lifestyle practices, relatively little research has been done to determine the cost impact of using unhealthy lifestyle practices. Because of the lack of research, particularly in the military, this thesis will examine the medical cost associated with certain unhealthy lifestyle practices in a military population.

B. SUPPLY-SIDE REFORM AND COST-CONTAINMENT INITIATIVES

Health-care reform is no longer the topic of debate solely between the medical professionals, insurance carriers, or the politicians. Instead, health-care reform, largely due to the

1992 Presidential election, has taken center stage with the American public, including the Defense Department. In becoming a political issue, health care reform is being accelerated, beyond the current market-driven forces.

While there is no one sure shape these reform plans should take, there are several common reoccurring themes that are present in each of the various public and private health care reform proposals [Ref. 12]. The first theme centers around the need to have service continuums that offer integrated provider networks for defined populations. The second theme is of increased consolidation between insurance and provider networks. This consolidation will bring a greater amount of risk to the providers. The third theme is that universal coverage, covering "core" benefits, must be granted to all citizens. The fourth theme is that there is increased cost-effectiveness in consolidated purchasing groups, which in turn brings increased buying power. Finally, the fifth theme is that there will be increased pressure placed on provider networks to compete for patients based on the value of delivered services, and the use of outcomes to measure this value.

1. National, State, Corporate Reform

Attention to past cost-containment measures have provided little success in dampening the ever-increasing health-care costs in the United States [Ref. 13]. Given this

pressing problem, with seemingly little cooperative action in sight, the President of the United States has presented the nation with a "bold and far-reaching - but complex and politically vulnerable - plan to...." bring about national health-care reform [Ref. 14].

This plan, labeled the *American Health Security Act of 1993*, embraces the basic tenants of managed competition through a reliance on market-oriented competition and government intervention. Promising "cradle-to-grave" health coverage for all United States citizens the President's plan offers six major principles [Ref. 15]. These principles are as follows:

- Security in health coverage through universal coverage.
- Costs control through increased competition in the health care market.
- Quality of care improvement.
- Expanded access to care.
- Decreased bureaucracy.
- Decreased fraud and abuse. [Ref. 16]

It is not surprising, however, that this massive and complex plan has its critics [Ref. 17], especially when much health care reform has already been done through non-government led initiatives. One clear example of these initiatives include the growing enrollment in private managed-care plans. Regardless of these critics, it is apparent that

national health-care reform will add to the pace of change in the health care environment.

While national health-care reform is debated, individual states have begun to implement their own supply-side oriented cost-containment initiatives. These initiatives have been prompted by rising health-care expenditures, extended economic recessions, austere state budgets, and other harsh social and economic realities that face the states. Facing these conditions the states have implemented their own type of reform in order to control health-care costs, increase access to health-care services, and to reform the small-group health insurance market [Ref. 18]. In fact, as of March 1993, approximately 70 percent of the states had some type of reform for the small group health insurance markets [Ref. 19]. Other state driven initiatives include Hawaii's universal health coverage, Vermont's setting of hospitals budget targets in 1993, and budget limits in 1994, and California's Health Insurance Plan of California (HIPC). HIPC, through managed competition, hopes to offer better rates and benefits, lower administrative costs for company's with between five and 50 employees, and provide a possible model for national reform. [Ref. 20][Ref. 21]

Facing similar increases in medical-care costs, as the public sector, large corporations are following through with their own initiatives in order to contain rising costs. Gillette, for example, has instituted supply-sided cost

controls such as improved methods for the delivery of care (in-house medical facilities), and have insisted on greater accountability from their health care plan in order to contain their health care costs [Ref. 22].

2. Department of Defense

The Military Health Services System (MHSS) is undergoing fundamental changes in its operating environment. As the nation's largest employer, the military is confronting previously unforeseen challenges in managing its resources to meet the growing cost of medical care. To assist in meeting these challenges, as well as being in concert with the President's health-care-reform plan, military health care has begun to redefine how it does business. In particular, the Department of Defense (DoD) has created the TRICARE Program to manage peace-time medical care in an integrated fashion between the military medical facilities and the delivery of peace-time medical care to family members.

However, the medical departments have two competing and sometimes divergent missions. As expressed by the Deputy Secretary of Defense's October 1, 1991 memorandum entitled *Strengthening the Medical Functions of the Department of Defense*, states:

> [T]he medical mission of the Department of Defense (DoD) shall be: (a) to provide, and to maintain readiness to provide, medical services and support to the armed forces during military operations and (b) to provide

> medical services and support to members of the armed forces, their dependents, and others entitled to DoD medical care.

In order to accomplish both facets of this mission the MHSS has secured a place in national health care reform with its implementation of TRICARE.

TRICARE offers several fundamental supply-side shifts in how the military health care environment operates. One such shift is offering local commanders the opportunity to be directly accountable for how medical care is delivered in the local area. As such, local commanders will have the flexibility and responsibility to control the accessibility, cost, and quality of care being provided in their specific catchment area.

Due to this increased accountability, flexibility, and responsibility the MHSS has instituted three additional supply-side cost-containment components within TRICARE in order to find the most cost-effective and delivery-efficient health-care options possible. These include developing regional lead agents to execute regional health-services plans, bringing capitation-based resource-allocation methods on-line, and procuring managed-care support (MCS) contracts for each of the health-service plans [Ref. 23]. In sum, the MHSS, under TRICARE, will become a DoD managed-care health-care system.

C. DEMAND-SIDE COST-CONTAINMENT INITIATIVES

It is difficult to deny the logic that preventable diseases incurred by unhealthy lifestyle practices, such as lung disease by smoking, will bring greater health-care utilization and cost to both the supplier and demander of health care. As such, both the public and private sectors have begun to explore and implement policy and programs that try to decrease health-care utilization and cost through demand-driven strategies, such as health promotion and wellness programs.

1. National

A national agenda for health promotion and prevention to curb preventable health-care costs was attained through the 1979 publication of *Healthy People: The Surgeons General's Report on Health Promotion and Disease Prevention* [Ref. 24]. This report was expanded in 1980 as *Promoting Health/Preventing Disease: Objectives for the Nation* [Ref. 25]. These publications established a ten year agenda to prevent unnecessary disease and to gain a better quality of life for the citizens of the United States. In 1990, an updated national agenda was set out in *Healthy People 2000* [Ref. 26]. This agenda has 22 measurable targets to be achieved by the year 2000. Twenty one of these 22 targets are grouped into three major categories: increasing the span of healthy life for Americans, reducing health disparities among

Americans, and achieving access to preventive services for all Americans.

Embracing *Healthy People 2000*, the President's *American Health Security Act* encourages demand-driven cost-containment through health research, public health initiatives, personal responsibility for one's own health, and health prevention [Ref. 27][Ref. 28]. The recognition that these initiatives are needed, and that they support the objectives in *Healthy People 2000*, provide promise for the future that a healthier life can contribute to containing preventable health care costs in the United States.

2. Corporate

The rise in medical-care cost, as a percentage of corporate business expenses, has forced the business community to initiate demand-side strategies to contain medical-care costs. One such strategy is to use health promotion (HP) programs to improve the health of their workers, decrease absenteeism and turnover, as well as to decrease the company's own medical care costs [Ref. 29]. Though there has been skepticism on whether or not these programs produce any medical-care economic dividends [Ref. 30], the corporate community has embraced such demand-side strategies. In fact, it was estimated that in 1988 the majority of worksites with over 50 workers had some type of HP activities [Ref. 31].

3. Department of Defense

Since the early 1980's, DoD has been an advocate for work-site HP programs. In 1986, the DoD's HP policy became formally coordinated by the DoD Directive 1010.10, *Health Promotion* [Ref. 32]. This directive implemented HP programs that "emphasized the following areas known to be related to increased longevity and improved health:" [Ref. 33]

- smoking prevention and cessation,
- physical fitness,
- nutrition,
- stress management,
- alcohol and drug abuse prevention, and
- early identification of hypertension.

To be in concert with the national policy on health promotion, the military has subsequently adopted the policy statements of *Healthy People 2000*. In order to achieve the objectives of *Healthy People 2000*, the military's Subcommittee on Health Promotion Program Evaluation has identified 181 *Healthy People 2000* objectives as being relevant to the military [Ref. 34]. The subcommittee has also identified 45 of these 181 objectives to be analyzed through the collection and establishment of baseline data.

Examples of HP programs integrated into the military workplace are the comprehensive smoking ban within DoD facilities, recruit training that emphasizes a "holistic"

approach to health [Ref. 35], and an innovative ship-board wellness program in the Navy [Ref. 36].

While the military has a comprehensive health promotion and disease prevention program, little research has been done concerning medical-care costs associated with lifestyle practices. The research that has been done has focused on the costs of smoking in the military [Ref. 37] and the costs of heavy drinking and healthy smoking in the military [Ref. 38].

D. RESEARCH OBJECTIVES

The primary objective of this thesis is to statistically examine whether there is a cost impact on medical care, in site-specific medical services (SSMSs), as a result of military personnel engaging in unhealthy lifestyle practices (ULSPs). In doing so, this study will determine if there is a medical-care cost increase that derives from an "unhealthy" lifestyle versus a "healthy" lifestyle. This thesis will also statistically examine, through cross-tabulations, the surveyed population with respect to ULSPs, SSMSs, and branch of service.

E. SCOPE AND LIMITATIONS

This thesis used the *1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel (1992 Worldwide Survey)* data set, compiled by the Research Triangle

Institute (RTI), in order to achieve the research objectives.

The limitations of using this data are several. These limitations are listed below:

- Age of surveyed population: The surveyed population has a relatively young mean age of 28.9 years. As such, ULSPs that are associated with certain diseases in the latter stages of life (e.g., smoking and lung disease) may not be seen in an active-duty population such as the one surveyed.
- Medical Care Costs: Only the estimated average costs of seeing a military or civilian provider for selected SSMSs were used. Other possible costs such as lost productivity and absenteeism were not able to be included.
- Fit-for-duty Population: The surveyed population only includes active-duty personnel that are fit-for-duty. The survey does not include active duty on medical boards, retirees, family members, or others.
- Self-reporting bias: Though the *1992 Worldwide Survey* was confidentially administered there is a possibility for self-reporting bias. The potential for this bias is not empirically examined in this thesis.
- Cross-sectional study: The data collected in the *1992 Worldwide Survey* represents only one year's worth of data. Though other *Worldwide Surveys* have been done, the data to determine the cost impact of SSMSs, due to ULSP use, was not collected. Therefore, trend analysis cannot be done.

F. METHODOLOGY

The methodology used for this thesis will follow the methodology used by the RTI in the *1992 Worldwide Survey*. Using this methodology, RTI examined the cost impact that heavy smoking, heavy drinking, and heavy drinking and heavy smoking had on specific SSMSs [Ref. 39].

The specific methodology used was a progressive four-step analysis. The first step was to determine a statistical modeling strategy that could be used to isolate ULSPs that had a statistically significant effect on a particular SSMS. The second step was to determine two probabilities of using a SSMS, provided an ULSP was significant. The first probability was the probability of using the SSMS, given that the ULSP was used. The second probability was the probability of using the SSMS, given that the ULSP was not used. The third step was to estimate the number of times a SSMS was used, on a per-person and DoD-wide basis, for both the users and non-users of an ULSP. Finally, the fourth step was to estimate the total DoD cost impact that each significant ULSP had on its corresponding SSMS.

II. LITERATURE REVIEW

The research-based link between lifestyle practices and medical-care costs has been established through a series four relationships. The four include the relationship between lifestyle practices and physical-health status, lifestyle practices and mortality rates, lifestyle practices and medical-care utilization, and lifestyle practices and medical-care costs. This chapter will review each of these relationships.

A. LIFESTYLE PRACTICES AND PHYSICAL HEALTH STATUS

The potential for medical care savings, based on modifying lifestyle practices, begines in the literature that examined the relationship between certain lifestyle practices and a person's physical health status. The landmark effort in examining this lifestyle habit/physical health relationship was completed by Belloc and Breslow in 1972 [Ref. 40]. Using data obtained by the Human Population Laboratory (HPL) of Alameda County, California, Belloc and Breslow's research differed from previous lifestyle practice/physical health status research because of the sampled population. Whereas previous research only used very specific sampled populations (e.g., retirees), the HPL data base allowed Belloc and Breslow

to examine the lifestyle practice/physical health status relationship on a general adult population.

Belloc and Breslow's research found a positive relationship between seven lifestyle practices and a person's physical health status. This was accomplished by using a defined measuring mechanism to categorize a person's physical health status, in relation to other people from the same population. In addition, Belloc and Breslow found that there was a positive relationship between the number of lifestyle practices practiced and a person's health status. Also, they found that the relationship between lifestyle practices and physical health status was cumulative; those who partook in all the practices were in better health than those who did not.

Listed below are the seven lifestyle practices that Belloc and Breslow found, and their individual relationship to physical health status.

1. Sleep: Sleeping 7-8 hours per night had a more favorable effect on health in comparison to those who slept 9 or more hours or 6 or less hours per night.

2. "Snacking": Eating regular meals, versus erratic eating, was found to be associated with better health.

3. Breakfast eating: Those who ate breakfast almost everyday reported better physical health than those who did not.

4. Body weight: Better physical health was reported by men who were between 5% underweight and 19.99% overweight, whereas women had better physical health when they were less than 10% overweight.

5. Exercise: Those who participated in active exercise were healthier than those who did not.

6. Alcohol Consumption: Moderate consumption of alcohol, or abstaining, was found to be healthier than heavy alcohol consumption.

7. Smoking: Those who never smoked were healthier than those who have, or who were current smokers.

B. LIFESTYLE PRACTICES AND MORTALITY

Five and a half years after the HPL collected its data in Alameda County, Belloc examined the relationship between lifestyle practices and mortality rates [Ref. 41]. Belloc's study found that there was an inverse relationship between the number of healthy lifestyle behaviors practiced and mortality rates.

Two other follow-up studies were conducted using the HPL data set. A nine year follow-up, conducted by Breslow and Enstrom [Ref. 42], found similar mortality rates to the 1973 study. A nine and a half year follow-up study, conducted by Wiley and Camacho [Ref. 43], found a positive relationship between five of the seven lifestyle practices, excluding eating breakfast and snacking, and future health.

C. LIFESTYLE PRACTICES AND MEDICAL-CARE UTILIZATION

Research that investigated the relationships between lifestyle practices, physical health status and mortality rates was followed by research that examined the relationship between the use of lifestyle practices and medical-care

utilization. Two studies that explore this lifestyle practice/medical-care utilization relationship are presented here.

The first study was done by Wetzler and Cruess [Ref. 44]. Using the *1977 National Health Interview Survey*, Wetzler and Cruess examined the relationship between lifestyle practices and medical-care utilization for people between the ages of 20 and 99. The independent variables included the seven Belloc and Breslow lifestyle practices and the dependent variables were the number of doctor visits, short-stay hospital days, and dental visits in the last 12 months.

The findings of Wetzler and Cruess' study are as follows. There was a significant relationship between hours of sleep and doctor visits and hospital days. Physical activity and drinking less than five alcoholic drinks at one sitting had a significant relationship with fewer doctor visits. In addition, Wetzler and Cruess found that by increasing the number of lifestyle behaviors practiced, both doctor visits and hospital stays progressively declined. The only lifestyle practice that had a significant relationship with dental visits was cigarette smoking. In this instance, those who never smoked cigarettes had fewer dental visits than those who were former or present smokers.

The second study was conducted by Pope [Ref. 45]. This study examined the relationships between various categories of medical-service contacts and different levels of three

lifestyle practices (drinking alcohol, smoking, and physical activity). The data used for this study included up to seven years of utilization data, as well as survey responses concerning lifestyle practices. The sampled population was a randomly selected group of adults who were in a health maintenance organization (HMO). And, for the study, the sample was divided into several age/sex classifications.

Pope's results are as follows. Drinking behavior was found to have few significant relationships associated with the use of medical care services, within most age/sex classifications. The relationship between smoking and medical care usage tended to be small and negative. And, there was a general tendency for those who had higher levels of physical activity to be associated with a lower amount of medical contacts.

D. LIFESTYLE PRACTICES AND MEDICAL CARE COST

The examination of the potential lifestyle practice/ medical-care cost relationship has been spurred on by the business community and its institution of HP programs that encourage the use of healthy lifestyle practices (e.g., increase physical activity, weight loss, smoking cessation). In theory, the logical appeal of HP programs is not only healthier employees, but also employees who have reduced medical-care costs [Ref. 46]. This section will examine

several studies that research this relationship and it will review the applicability of such studies.

In 1985 Gibbs, Mulvaney, Henes, and Reed [Ref. 47] examined the relationship between work-site health promotion programs and medical-care costs, as measured by insurance claims. The sample population consisted of two groups. The test group, employees from a Canadian life insurance company, were encouraged to participate in a supervised program that included calisthenics and endurance-type activity. The second group, from a similar insurance company, did not receive the programmed activities. Two findings were generated from this study. The first finding was that program participants tended to have higher medical-care costs in the first six-months after the program began. The second finding, however, was that the same program participants had lower medical care costs for subsequent periods. Over a 4.75 year time frame, the reduction in medical care costs was 24% lower for program participants versus non-program participants.

Similar to the Gibbs, et al., study, Baun, Bernacki, and Tsai examined the possible cost savings from having a HP program [Ref. 48]. However, the Baun, et al., study only examined the cost difference between exercisers and non-exercisers from a large United States corporation. The results of this study concluded that total medical-care costs, both inpatient and outpatient, were lower for exercisers (male $561, female $639) than for non-exercisers (male $1,003 female

$1,535). However, these differences were found not to be significant. When examining only outpatient medical costs they found that the non-exercisers had significantly higher medical care costs than those who exercised. As Baun, et al., suggest though, the difference in outpatient medical costs may be attributable to the general characteristics of one who exercises.

Other research includes two studies by Shepard, Corey, Renzland, and Cox, a study by Bly, Jones, and Richarson, and a study by Leigh and Fries. The first Shepard, et al., study compared health care costs at two financial service companies, one year prior and one year post to the introduction of a corporate fitness program [Ref. 49]. While savings were seen in both the control and the experimental groups, there was a projected medical-care savings for those who participated in the program. This savings was, on average, $84.50 per employee, per year. The second Shepard, et al., study, however, found only "slender" relationships between medical care costs and lifestyle practices [Ref. 50].

The Bly, et al., study examined the relationship between medical-care costs and a comprehensive worksite HP program at the Johnson & Johnson corporation [Ref. 51]. The sampled population consisted of two experimental groups of employees who participated in Johnson and Johnson's "Live for Life" (LFL) program and one control group of employees who did not.

The study was conducted over a five year period and reported findings for both inpatient and outpatient medical care costs.

The inpatient medical care costs increased for all three groups. However, inpatient costs increased only $43 and $42 for the two LFL participating groups, versus $76 for the non-LFL participating group. No significant differences in outpatient costs were found when examining the differences between the participants and non-participants.

The Leigh and Fries [Ref. 52] study examined the relationship between lifestyle practices and medical care costs in a retiree population. The results of this study suggested that savings of $372 to $598 in direct costs and $4,298 in total cost per-person, per-year were realized for retirees who did not smoke or drink excessively, who had increased physical activity and seat belt use, and who were not 33% over the mean body mass.

While the previous review of studies has shown that medical-care costs can be positively impacted by HP programs that promote healthy lifestyle practices, Warner, Wickizer, Wolfe, Schildroth, and Samualson have placed skepticism on such research. In their review of the literature, Warner, et al., examined the economic implications of ten health promotion programs, including smoking cessation, nutrition and weight control, and exercise [Ref. 53]. Findings showed that, in general, there was only anecdotal evidence to suggest that there were any economic gains by using health promotion

programs. However, they contend that this may be based not so much on the non-relationships between the health promotion programs and decreasing cost, but on flawed research methodologies.

E. CONCLUSION

In defining the relationship between lifestyle practices and medical-care cost, this chapter has explored the relationships between lifestyle practices and physical health status and mortality and medical utilization rates. In sum, evidence has been found to suggest that participation in specific healthy lifestyle practices improves health status, decreases mortality rates, decreases medical care utilization, and decreases medical care cost. However, there is some skepticism concerning the link between lifestyle practice-based HP programs and decreased medical-care costs.

III. METHODOLOGY

The purpose of this thesis is to determine whether there is a cost impact on medical care for SSMSs as a result of military personnel engaging in ULSPs. This chapter discusses the methodology, data set, and computer software used to obtain the empirical results for this purpose.

A. METHODOLOGY

The methodology used to obtain empirical results for the purpose of this thesis was a progressive four-step analysis[1]. The first step was to determine a statistical modeling strategy that could be used to isolate ULSPs that had a statistically significant effect on a particular SSMS. The second step was to determine two probabilities of using a SSMS at least once, conditional upon the use of an ULSP, provided the ULSP was significant. The first probability was the probability of using the SSMS, given that the ULSP was used. The second probability was the probability of using the SSMS, given that the ULSP was not used. The third step was to estimate the number of times a SSMS was used, on a per-person and DoD-wide basis, for both the users and non-users of an

[1] RTI used this same methodology to determine the cost impact of heavy drinkers, heavy smokers, and heavy smokers and heavy drinkers on the same site-specific medical services used in this thesis.

ULSP. The fourth step was to estimate the total DoD cost impact that each significant ULSP had on its corresponding SSMS.

1. Step 1: Modeling Strategy

Determining which ULSPs had a significant effect on a particular SSMS was done in two stages. The first stage was to define what particular ULSPs and SSMSs were going to be used. The second stage was to determine a general regression equation that allowed for finding which ULSPs might have a significant effect on a SSMS.

a. Stage 1: Variable Definition

From the *1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel* (*1992 Worldwide Survey*) data base, six medical services were chosen as dependent variables. These are identified in Table I. Of note is that these dependent variables are binary variables coded either 0 or 1. Therefore, each dependent variable has a discrete outcome indicating whether or not a person used the SSMS, at least once.

The independent variables chosen are indicated in Tables II and III. Table II describes the ULSP variables, and Table III the persoanl demographic variables. The ULSP variables were chosen so as to replicate, in the constraints of this methodology, Belloc and Breslow's seven variables discussed in Chapter II. The personal demographic variables

were chosen to replicate the demographic variables used by RTI in their heavy smoking/heavy drinking study. Similar to the dependent variables, all the independent variables, with the exception of AGE, were coded as discrete binary variables.

TABLE I. DEPENDENT VARIABLE DEFINITION

DEPENDENT VARIABLES	DESCRIPTION
ERVIS	= 1 if had at least one emergency room visit in 1992 = 0 otherwise
SPECVIS	= 1 if had at least one medical specialist visit in 1992 = 0 otherwise
MILOPV	= 1 if had at least one outpatient visit to a military general practitioner in 1992 = 0 otherwise
CIVOPV	= 1 if had at least one outpatient visit to a civilian general practitioner in 1992 = 0 otherwise
GRWKSTAY	= 1 if had at least one inpatient stay for one week or more = 0 otherwise
LSWKSTAY	= 1 if had at least one inpatient stay for less than one week = 0 otherwise

TABLE II. UNHEALTHY LIFESTYLE PRACTICE INDEPENDENT VARIABLES

INDEPENDENT VARIABLE: ULSP	DESCRIPTION
HVYSMK	= 1 is smoke at least one pack of cigarettes per day = 0 otherwise
CFSK	= 1 if current or former cigarette smoker = 0 if never smoked cigarettes
HVYDRK	= 1 if drink 5 or more alcoholic drinks per typical drinking occasion at least once a week = 0 otherwise
GRMODDRK	= 1 if drink at least 2-4 alcoholic drinks per typical drinking occasion at least once a week or five or more drinks per typical drinking occasion 2-3 times per months = 0 otherwise
N2MEALS	= 1 if does not eat at least 2 full meals in one day, at least five times per week = 0 otherwise
NBREAK	= 1 if does not eat breakfast at least five times per week = 0 otherwise
NEXER	= 1 if does not participate in 20 minutes of strenuous exercise at least 3-4 times per week = 0 otherwise
NSLEEP	= 1 if does not get more than 6 hours of consecutive sleep at least five times per week = 0 otherwise
DRGUSE	= 1 if used marijuana and/or any other drug, except for steroids = 0 otherwise

TABLE III. PERSONAL DEMOGRAPHIC INDEPENDENT VARIABLES

DEMOGRAPHIC VARIABLES	DESCRIPTION
SERVICE ARMY NAVY MARINE (AIR FORCE OMITTED)	= 1 if Army; 0 otherwise = 1 if Navy; 0 otherwise = 1 if Marine; 0 otherwise
RACE BLACK HISPANIC OTHER (WHITE OMITTED)	= 1 if black; 0 otherwise = 1 if hispanic; 0 otherwise = 1 if other race; 0 otherwise
EDUCATION GRHS	= 1 if have greater than a high school education = 0 otherwise
AGE	Continuous age variable
FEMALE	= 1 if female; 0 otherwise
DSTORM	= 1 if serviced in Middle East as part of Desert Storm/Shield = 0 otherwise

b. Regression Model Definition

Because the dependent variables are binary in nature a logistic model was used:

$$\text{USE SSMS}_i = f(\text{ULSP}_j, \text{PERSONAL DEMOGRAPHICS})$$

where the variables are defined in Tables I-III.

With the general logistic regression model above, each separate SSMS was examined against each separate ULSP, with the same demographic variables in every equation. This led to a total of 54 (6 SSMSs * 9 ULSPs) separate logistic regression equations. Each independent variable, in each of these 54 equations, was examined for statistical significance,

at the .05 level.

2. Step 2: Determine Probabilities of Using Significant ULSP

By using a logistic regression model, it was possible to compute the probability of using a SSMS, at least once, conditional upon the use of an ULSP. This was done by using a "notional person" procedure on each of the ULSP variables that were found to have a significant effect on a corresponding SSMS. Each of the 54 equations was run twice. The first time was for independent-variable data describing a "notional person", or average person, with the ULSP variable coded one. The value of an independent variable for a "notional person" is the average value of that variable over all the people sampled. The second time the equations were run the same procedure was used, except with one difference: The coefficient of the significant ULSP was coded as the percentage of ULSP users. As a result of this procedure, two probabilities emerged. The first is the probability that a "notional person" will use the SSMS at least once, given that the ULSP was used. The second is the probability that a "notional person" will use the SSMS at least once, given that the ULSP was not used.

3. Step 3: Estimate Number of Per-Person and Total DoD Visits for SSMS, Conditional Upon the Use of ULSP

Once the probabilities were found, the next step was to compute the number of visits, on a per-person and total DoD basis, for the SSMS, conditional upon using and upon not using the ULSP that was found to be significant. This was done by multiplying each of the two probabilities by the mean per-person number of visits that a person having at least one visit had for one year. The results were the predicted number of per-person SSMS visits for the two ULSP groups (ULSP user and ULSP non-user). Once these numbers were found, they were multiplied by the number of DoD personnel who did (or did not) use the ULSP. This procedure produced the total number of DoD visits for each SSMS for each of the two ULSP groups (ULSP user and ULSP non-user)-- for every significant ULSP and for every SSMS studied.

4. Step 4: Estimate Total DoD Cost on SSMS, Conditional Upon the Use of ULSP

To estimate the total cost impact on a SSMS, conditional upon the use of an ULSP, two additional procedures were followed. The first procedure was to multiply the total number of DoD visits for each ULSP group (ULSP user and ULSP non-user) by the average per-visit cost of the particular SSMS. (Table IV shows the average cost for each SSMS.) This multiplication resulted in two sub-total DoD cost figures.

The first was the sub-total DoD cost for the SSMS, given that an ULSP was used; the second was the sub-total DoD cost for the SSMS, given that the ULSP was not used. By adding the two sub-total costs together, the *actual* total DoD cost for providing SSMS care to the population was obtained.

TABLE IV. AVERAGE COST FOR A SSMS

SITE SPECIFIC MEDICAL SERVICE	AVERAGE COST
ER VISIT	$ 63
SPECIALIST VISIT	$ 102
MILITARY OUTPATIENT VISIT	$ 63
CIVILIAN OUTPATIENT VISIT	$ 70
INPATIENT STAY AT LEAST ONE WEEK	$5,630
INPATIENT STAY LESS THAN ONE WEEK	$1,970

Source: *1992 Worldwide Survey of Substance Abuse and Health Behaviors Among Military Personnel*

The second procedure was to replace the cost for the first sub-total (ULSP user cost) by the cost that the ULSP user group would have if it consisted of ULSP non-users. This new first sub-total group has now been *reclassified* from ULSP users to USLP non-users. The *reclassified* sub-total is then added to the original second sub-total. Then, as in the preceding procedure, the two sub-group totals were added together to give a *hypothetical*[2] DoD total cost. Then the

[2] By adding the *reclassified* first sub-total cost to the original second sub-total cost a cost figure that represents a population with only ULSP non-users is

total incremental cost for a SSMS due to an ULSP was determined by substracting the total *hypothetical* cost from the total *actual* cost.

B. DATA SET

The *1992 Worldwide Survey* data base, compiled by the Research Triangle Institute (RTI), was subjected to the methodology described. The *1992 Worldwide Survey* is the fifth in a series of single-year, cross-sectional surveys that examine the prevalence of alcohol, tobacco, and drug use among military personnel around the world. The four previous surveys were done in 1980, 1982, 1985, and 1988. Beginning in 1985, the surveys began to collect additional data concerning other lifestyle habits (e.g., exercise). The *1992 Worldwide Survey* collected additional information: data concerning medical service use (e.g., How many times did you see a military outpatient physician?). This new data, coupled with the lifestyle-habit data, allowed for an examination of the possible additional cost incurred on SSMSs, conditional upon the use of an ULSP.

1. Sampling Design

The particular sampling design that RTI used for the *1992 Worldwide Survey* is called a two-stage cluster sampling design. The sampling was done in two phases. The first phase

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obtained. This type of population is *hypothetical* because every actual population has at least one ULSP user.

had two stages. The first stage divided the eligible military population into worldwide geographical units within each service. These units were called first-stage units (FSUs). The second stage divided each FSU by paygrades E-1 through O-10. The second phase of the sampling design further manipulated the eligible population by reinstating those who where absent, but eligible, during the phase-one portion of the survey[3].

Once the two phases were completed, RTI was able to use 16,395 questionnaires from the original 25,887 persons originally selected and eligible for the survey.

C. SOFTWARE USED

Because of the complex sampling design of the *1992 Worldwide Survey*, this thesis used RTI's Survey Data Analysis (SUDAAN) software [Ref. 54]. In doing so, increased accuracy was obtained for estimating the variances of the survey statistics (e.g., means, regression coefficients). More common statistical software packages (e.g., SAS) are not able to accurately process data obtained from such complex sample designs because they assume the data comes from simple random

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[3] The *1992 Worldwide Survey* report provides a more extensive technical review of the sampling design methodology. This report can be obtained from the Department of Defense (Health Affairs), or Department of Defense Coordinator for Drug Enforcement Policy and Support, contract number MDA 903-91-C-0220.

samples [Ref. 55].

D. SUMMARY

This chapter has described the methodology, data set, and software used to find the potential incremental cost impact on a SSMS, conditional upon the use of an ULSP. The methodology involved the use of a logistic regression model in order to determine the probability of a SSMS visit by a person who used or did not use an ULSP. The methodology also involved the estimation of the number of SSMS visits by both users and non-users of an ULSP. The results were estimates of the total DoD incremental cost impact of all ULSP users for each SSMS.

IV. FINDINGS

This chapter presents the results of using the methodology, prescribed in Chapter III, in order to estimate the cost impact on medical care for SSMSs, as a result of military personnel engaging in ULSPs. This chapter also presents the results of the cross-tabulations done on the personal demographic characteristics of the surveyed population, the number of ULSP users, mean number of SSMS visits, and military provided health promotion initiatives. Further, this chapter provides analytical interpretation and inference concerning the reported findings.

A. DESCRIPTIVE STATISTICS

This section of the chapter examines the proportional differences between the sampled military services with respect to personal demographic characteristics, use of the selected ULSPs and SSMSs, and the use of health promotion initiatives.

1. Personal Demographic Characteristics

The final surveyed sample consisted of 16,395 eligible personnel that were selected in the two sampling design phases. Basic demographic characteristics of the sample appear in Table V.

TABLE V. PERCENTAGES FOR DEMOGRAPHIC CHARACTERISTICS OF SURVEYED POPULATION, PER SERVICE

CHARACTERISTIC	ARMY	NAVY	MARINE	AIR FORCE	DOD
SEX					
MALE	86.21	80.07	96.14	84.63	84.97
FEMALE	13.79	19.93	3.86	15.37	15.03
RACE					
BLACK	27.31	17.68	19.35	14.53	19.93
HISPANIC	10.29	6.79	8.06	6.92	8.04
OTHER	5.04	7.12	3.79	3.79	5.16
WHITE	57.36	68.92	68.92	74.76	66.96
EDUCATION					
GREATER THAN H.S.	61.46	53.20	36.35	77.98	61.00
MEAN AGE (yrs)	29.16	28.45	26.22	30.25	28.90
MARITAL STATUS					
NOT MARRIED	33.86	43.59	50.33	29.96	37.43
MARRIED	66.14	56.41	49.67	70.04	62.57
PAYGRADE					
E1-E4	41.89	42.82	57.29	35.33	41.95
E5-E6	28.92	35.76	23.43	33.96	31.83
E7-E9	11.26	9.79	8.34	10.70	10.35
W1-W4	2.54	.49	1.07	0.00*	1.04
01-03	8.82	6.71	6.52	12.16	8.89
04-010	6.57	4.41	3.31	7.85	5.93

* There are no warrant officers in the Air Force

As shown in Table V, the majority of personnel who were surveyed were white (66.96%), male (84.97%), educated beyond high school (61.00%), almost 29 years old, married (62.57), and held the rank between E-1 and E-4 (41.94%). At the service level, the Marines had the largest percentage of males, the Army had the largest percentage of non-whites, and the Air Force had the largest percentage of personnel who had more than a high school diploma, the most married, and the

oldest population. Finally, the Marines had the largest percentage of junior enlisted personnel.

2. ULSPs and the Services

Table VI presents the usage percentages, by service, for the ULSPs used in the modeling strategy. A star (*) by the highest percentage shows which service had the most users for each ULSP.

The most users for six of the ten ULSPs are the Marines. The six include both drinking and smoking variables, as well as drug use and not eating breakfast at least five times per-week. Not surprising, however, the Marines also had the lowest number of personnel who did not vigorously exercise.

Opposite from the Marine personnel, the Air Force holds the lowest percentages for six of the ten ULSP. These include both smoking and drinking ULSPs and NSLEEP and DRGUSE.

TABLE VI. PERCENTAGE OF ULSP USERS, PER SERVICE

ULSP VARIABLE	ARMY	NAVY	MARINE	AIR FORCE	TOTAL DOD
HVYSMK	18.02	20.35	*20.71	14.60	18.02
CFSM	61.41	63.07	*65.21	58.65	61.52
HVYDRK	17.22	13.80	*25.45	10.67	15.21
GRMODDRK	43.38	40.66	*50.49	36.17	41.27
N2MEALS	35.52	34.34	32.85	*33.90	34.14
NEXER	14.30	*41.95	15.89	37.62	29.42
NSLEEP	*46.49	45.65	43.26	32.48	41.90
DRGUSE	3.90	4.04	*5.63	1.24	3.37
NBREAK	60.63	63.99	*66.72	63.90	63.33

* Highest percentage amongst the services for particular ULSP

3. Mean Number of SSMS visits, by Service

While the Marines have the highest proportion of personnel who use a particular set of ULSPs, they do not correspondingly use the most SSMSs. Table VII describes the per-person mean number of SSMS visits greater than zero, by service and DoD-wide.

TABLE VII. PER-PERSON MEAN NUMBER OF SSMS, PER SERVICE

SSMS	ARMY	NAVY	MARINE	AIR FORCE	DOD
ERVIS	2.12	1.55	1.77	*1.81	1.85
SPECVIS	4.06	3.97	*4.07	3.53	3.87
MILOPV	*3.24	2.51	2.29	3.09	2.88
CIVOPV	*3.58	3.35	1.98	2.67	3.14
GRWKSTAY	*1.97	1.50	1.56	1.62	1.73
LSWKSTAY	3.51	*7.48	1.66	1.66	3.66

* Highest mean number of SSMS, by service

As shown, the largest means are well distributed throughout all four services. While the Army has three of the highest SSMS means, the differences among the services are relatively small. The largest difference of SSMS use occurs in the less-than-a-week-stay SSMS. Here the Navy far exceeds the other services in this SSMS category.

To further examine the reasons for seeing a doctor, a cross-tabulation was done for the four services and eight specific reasons for medical care. These medical reasons included seeing a doctor for a routine check-up or physical (CHECKUP), treatment of a physical illness or condition (PHYSILL), treatment or follow-up for an injury (INJURY),

medical care before or after delivery of a baby (BABY), outpatient surgery or surgery follow-up (SURGERY), mental health services or counseling (MENTILL), substance abuse treatment or counseling (SUBST), and treatment or counseling concerning sexually transmitted diseases (STD). The results of these cross-tabulations are presented in Table VIII. As expected, the most common reason for visiting a doctor is for a routine checkup or physical, followed by treatment of a physical illness or condition.

TABLE VIII. REASONS FOR DOCTOR VISIT, PER SERVICE

REASON	ARMY	NAVY	MARINE	AIR FORCE	DOD
CHECKUP	59.81	67.10	66.16	62.39	63.41
PHYSILL	55.48	55.03	52.71	63.55	57.50
INJURY	47.95	37.67	49.83	31.94	40.26
BABY	3.59	3.75	*.54	2.37	2.97
SURGERY	12.34	9.88	8.70	13.59	11.62
MENTILL	7.02	5.90	5.60	7.13	6.58
SUBST	1.75	1.13	*3.21	1.50	1.64
STD	4.70	6.64	11.04	4.20	5.77

* less than thirty personnel in category

4. Health Promotion Interventions

The discontinuation of an ULSP usually comes from a personal decision to stop using the ULSP. To assist in such decisions, external patient education, counseling, and other health promotion interventions are often used. For the sample studied, ten such interventions were surveyed. These included a blood pressure check (BLOOD), cholesterol check (CHOLEST), personal fitness assessment (PFA), Health Risk

Appraisal (HRA), and classes in stop-smoking (STOPSM), nutrition education (NUTRIT), back injury prevention (BACK), cancer prevention/awareness (CANCER), stress management (STRESS), and sexually transmitted disease education or counseling session (STDCLAS). Results, by service, of these interventions are presented in Table IX.

TABLE IX. PERCENTAGE OF PARTICIPANTS IN HEALTH PROMOTION/PREVENTION INTERVENTIONS IN LAST 12 MONTHS, PER SERVICE

MEASURE	ARMY	NAVY	MARINE	AIR FORCE	DOD
BLOOD	67.53	64.27	65.83	71.16	67.41
CHOLEST	42.79	28.78	21.03	43.10	36.39
PFA	29.87	25.93	23.64	25.77	26.85
HRA	22.09	8.49	2.43	10.60	12.66
STOPSM	4.28	3.73	2.21	2.34	3.34
NUTRIT	14.74	9.99	5.56	9.10	10.71
BACK	7.00	15.14	4.15	5.30	8.91
CANCER	4.31	4.01	1.88	1.25	3.10
STRESS	17.62	13.27	9.82	6.13	12.19
STDCLAS	21.92	18.54	22.24	4.17	15.86

Corresponding to reasons for medical care, where a physical checkup was the most common answer given, a blood pressure check was the most common answer given in Table IX. This is not surprising given that personnel usually have their blood pressure checked before each medical-service visit.

As in previous tables, the Marine personnel are near the bottom among all the services in the number of intervention. They are last in the interventions of CHOLEST,

PFA, HRA, STOPSM, NUTRIT, and BACK and they are also third in the CANCER and STRESS interventions. Not far behind the Marines is the Navy who is ranked last, or second to the last, in the first six interventions and the STD intervention.

B. COMPUTATION OF THE COST IMPACT ON A SSMS, CONDITIONAL UPON USING AN ULSP

In determining the cost impact on a SSMS, conditional upon using an ULSP, the methodology described in Chapter III was used. The results are presented in the same four steps that were described there.

1. Step 1: Modeling Strategy

The logistic regression model, defined in Chapter III, was used to determine which ULSPs and personal demographic variables had statistically significant effects on a SSMS. Table X shows the results of these computations.

TABLE X. SIGNIFICANT ULSPs ON SSMSs

SIGNIFICANT ULSP	SSMS
HVYSMK	MILOPV LSWKSTAY
CFSM	SPECVIS MILOPV ERVIS
HVYDRK	CIVOPV
GRMODDRK	MILOPV
N2MEALS	MILOPV
NEXER	CIVOPV GRWKSTAY
NSLEEP	CIVOPV
DRGUSE	LSWKSTAY MILOPV
NBREAK	(NONE)

Table X can be interpreted in the following manner: Heavy smoking (HVYSMK) has a statistically significant effect on the use of military outpatient visits (MILOPV), as well as staying less than one week in a hospital (LSWKSTAY). The other possible SSMS variables (SPECVIS, ERVIS, CIVOPV, GRWKSTAY) were not found to have significant relationships with HVYSMK. The variable NBREAK (not eating breakfast) was the only ULSP that did not produce any significant relationships. The remaining results can be read in a similar manner.

The personal demographic variables used in the 54 logistic equations showed several clear patterns of statistical significance for each of the SSMSs. The AGE variable had a significant effect on all the dependent variables except in the equation with HVYSMK and CIVOPV. AGE had a significantly negative effect on GRWKSTAY, ERVIS, LSWKSTAY, and CIVOPV and a significantly positive effect on MILOPV and SPECVIS. The variable FEMALE was found to have a positive significant relationship with all the SSMSs for all 54 equations. The variables GTHS and DSTORM did not show any patterns of significance.

Examination of the military service and race variables revealed several consistent patterns. ARMY always had a significant positive relationship with GRWKSTAY and a negative relationship with MILOPV. NAVY always had a significant negative relationship with ERVIS, LSWKSTAY, and SPECVIS.

MARINE always had a significant negative relationship with ERVIS and SPECVIS. Concerning race, BLACKS had a significant negative effect on MILOPV and on SPECVIS, except in the equations that had the ULSPs of CFSM and NBREAK. HISPANIC had no significant effect to any of the SSMSs. Finally, OTHER was generally found to have a significant effect on LSWKSTAY in the equations with the ULSPs of HVYSMK, CFSM, HVYDRK, GRMODDRK, NBREAK, N2MEALS, and NEXER.

2. Step 2: Probability of Using SSMSs, Conditional Upon the Use of an ULSP

The "notional person" procedure provided a mechanism to determine the probability of using SSMSs at least once, for both users and non-users of an ULSP. The results for the ULSPs that were found to have a significant effect on a SSMS are presented in Table XI.

In terms of HVYSMK and MILOPV as an example, the interpretation of Table XI is as follows: The effect of being a heavy smoker (ULSP user) on the probability of having a military outpatient visit, at least once, is .7120. This is greater than the probability (.6711) of having a military outpatient visit, at least once, if a person is not a heavy smoker (ULSP non-user). As indicated in Table XI, users of all the significant ULSPs have a greater probability of using the respective SSMS than non-users, with the exception of N2MEALS. This last result is interpreted as follows: those

who do not eat two meals per-day, at least five times a week, have a lower probability of using a civilian outpatient visit, at least once, than those who do eat two meals per-day, at least five times a week.

TABLE XI. PROBABILITY OF USING A SSMS AT LEAST ONCE, CONDITIONAL UPON THE USE OR NON-USE OF A SIGNIFICANT ULSP

SIGNIFICANT ULSP	SSMS	PROBABILITY OF ULSP USER	PROBABILITY OF ULSP NON-USER
HVYSMK	MILOPV	.7120	.6711
	LSWKSTAY	.0863	.0706
CFSM	SPECVIS	.2680	.2575
	MILOPV	.6809	.6710
	ERVIS	.3092	.2935
HVYDRK	CIVOPV	.0892	.0671
GRMODDRK	MILOPV	.6888	.6713
N2MEALS	CIVOPV	.6450	.6716
NEXER	CIVOPV	.0865	.0666
	GRWKSTAY	.0340	.0340
NSLEEP	CIVOPV	.0798	.0664
DRGUSE	LSWKSTAY	.1417	.0700
	MILOPV	.7796	.6708
NBREAK	(NONE)	.0000	.0000

3. Step 3: Estimated Number of Per-Person and Total DoD Visits for a SSMS, Conditional Upon the Use or Non-use of an ULSP

This section presents the estimate number of per-person and total DoD SSMS visits, conditional upon the use or non-use of an ULSP, in Table XII. The two categories of personnel are presented in each boxed row. The first is the estimated number of visits by those who use an ULSP, and the

second is the estimated number of visits by those who do not use the ULSP.

As indicated in the second row of Table XII, the estimated number of military outpatient visits for heavy smokers, who had at least one visit, is 2.05 visits per year. This is in contrast to the 1.93 visits that non-heavy smokers (non-users) have in using the same SSMS. While the number of per-person visits is greater for heavy smokers, the estimated number of total number of military outpatient visits for heavy smokers is far less for non-heavy smokers, .68 million for heavy smokers and 2.94 million for non-heavy smokers. This difference is due to the different number of personnel in each category. The estimated number of heavy smokers comprise only 18% (or 333,530) of the total DoD population, whereas non-heavy smokers comprise the remaining 82% (1,516,920). Therefore, even though the per-person visit rate is higher for heavy smokers, the large proportion of personnel who are non-heavy smokers raises the non-heavy smoker DoD visit count above the number of visits by heavy smokers.

Several further points can be made concerning Table XII. The first point is that it is not surprising that the users of an ULSP had greater per-person visit numbers than the corresponding non-users category. This result is due to the higher probability of the user compared to the non-user. The second point is that the ULSP of N2MEALS does not follow the

pattern of the other ULSPs because its probability was lower for users than for non-users.

TABLE XII. ANNUAL ESTIMATED PER-PERSON AND TOTAL DOD NUMBER OF VISITS TO A SSMS, CONDITIONAL UPON THE USE OR NON-USE OF AN ULSP

SIGNIFICANT ULSP	SSMS	NUMBER OF PER-PERSON VISITS	NUMBER OF TOTAL DOD VISIT
HVYSMK	MILOPV	2.05	.68 M
NON-HVYSMK	MILOPV	1.93	2.94 M
HVYSMK	LSWKSTAY	.12	.04 M
NON-HVYSMK	LSWKSTAY	.10	.15 M
CFSM	SPECVIS	1.04	1.18 M
NON-CFSM	SPECVIS	1.00	.71 M
CFSM	MILOPV	1.96	2.23 M
NON-CFSM	MILOPV	1.93	1.38 M
CFSM	ERVIS	.57	.65 M
NON-CFSM	ERVIS	.54	.39 M
HVYDRK	CIVOPV	.28	.08 M
NON-HVYDRK	CIVOPV	.21	.33 M
GRMODDRK	MILOPV	1.98	1.51 M
NON-GRMODDRK	MILOPV	1.93	2.10 M
N2MEALS	MILOPV	1.86	1.17 M
NON-N2MEALS	MILOPV	1.93	2.36 M
NEXER	CIVOPV	.27	.15 M
NON-NEXER	CIVOPV	.21	.27 M
NEXER	GRWKSTAY	.09	.05 M
NON-NEXER	GRWKSTAY	.06	.08 M
NSLEEP	CIVOPV	.25	.19 M
NON-NSLEEP	CIVOPV	.21	.22 M
DRGUSE	LSWKSTAY	.20	.01 M
NON-DRGUSE	LSWKSTAY	.10	.17 M
DRGUSE	MILOPV	2.25	.14 M
NON-DRGUSE	MILOPV	1.93	3.45 M
NBREAK	(NONE)	(NONE)	(NONE)

4. Step 4: Estimated Total DoD Cost on SSMSs, Conditional Upon the Use of an ULSP

The estimated incremental cost impact on SSMSs, conditional upon the use of an ULSP, is obtained from the results of the previous three steps. The cost impact for each ULSP and each SSMS is presented in Table XIII.

As shown in Table XIII, the ULSPs, that were found to have a significant effect on at least one SSMS, cost between -$3.1 million and $87.3 million per year for a SSMS. While these numbers vary greatly, the more important results reside in the last column entitled "% of total cost." This column indicates what percentage the cost impact, by the ULSP on the SSMS, is of the total DoD cost spent for each specific SSMS. For example, although heavy smoking adds $2.5 million to the cost of military outpatient visits, this amount is only 1.1% of the total DoD cost spent on all military outpatient visits for a fit-for-duty population.

While Table XIII indicates that the SSMS cost impact of the use of a ULSP can range from $1.2 million to $87.3 million, with the exception of N2MEALS on MILOPV, the results need to be viewed with caution for several reasons. The first three of which were also suggested in RTI's study on heavy drinking and heaving smoking [Ref. 56].

TABLE XIII. ANNUAL ESTIMATED COST IMPACT BY ULSPs ON SSMSs

SIGNIFICANT ULSP	SSMS	COST IMPACT	% OF TOTAL COST
HVYSMK	MILOPV	$2.5 M	1.1 %
	LSWKSTAY	$14.3 M	3.8 %
CFSM	SPECVIS	$3.6 M	2.4 %
	MILOPV	$2.0 M	.8 %
	ERVIS	$3.4 M	3.2 %
HVYDRK	CIVOPV	$1.4 M	4.9 %
GRMODDRK	MILOPV	$2.4 M	1.1 %
N2MEALS	MILOPV	-$3.1 M	-1.4 %
NEXER	CIVOPV	$2.4 M	8.1 %
	GRWKSTAY	$87.3 M	12.4 %
NSLEEP	CIVOPV	$2.3 M	7.8 %
DRGUSE	LSWKSTAY	$12.2 M	3.3 %
	MILOPV	$1.2 M	.5 %
NBREAK	(NONE)	$0.0 M	0 %

a. Wide Range of Percentages

The percentages for total cost range between -1.4% and 12.4%. As such, the question surrounding these percentages is one of tolerance. How high or low should these percentages be in order to be tolerable? For instance, is the 1.1% cost impact of HVYSMK on MILOPV an acceptable level? If not, what should this level be? Questions of this type need to be answered by DoD policy makers before an interpretation of such percentages can be given.

b. Possible Underestimation of Cost

The method used to determine the medical-care cost impact on a SSMS, by an ULSP, uses a very conservative cost estimate in the analysis. Consequently, the total costs results may be underestimated. For this analysis only the

average costs for each SSMS were used, and the costs resulting from absenteeism, lost productivity, pharmacy services, etc., are not included in this analysis.

Another reason for possible underestimation is the sampled population itself. As stated previously, the population is fit-for-duty and relatively young. Therefore, personnel who were seriously ill probably did not partake in the survey; and, with a mean age of 28.9 years, the population, by age alone, generally reflects a healthier population than an older population. An example of how this age characteristic might effect the cost impact is as follows: A heavy smoker, at 29 years old, most likely will not experience the medical effects of such an ULSP until later in a life. Therefore, the cost imposed by diseases that appear in the latter stage of life, that can be attributed to the ULSP (e.g., lung disease), are not reflected in this thesis' results.

c. Unknown Medical Reasons for SSMS

An unknown factor in this analysis is the reasons for the SSMS, conditional upon the use of an ULSP. This analysis does not take into account why a person went to the SSMS; rather, this analysis only determines whether a person did use the SSMS. This lack of knowledge may cause either, or both, underestimation or overestimation of the total cost impacts results.

C. CONCLUSION

Application of the methodology developed by RTI to determine whether there was a cost impact on a SSMS, as a result of military personnel engaging in an ULSP, produced modest results. However, there is sufficient evidence to conclude that certain ULSPs do have an effect on the overall cost of specific SSMSs. This is an important finding especially when considering that the sampled population is relatively young and healthy.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This thesis has conducted a statistical analysis to examine whether there is a cost impact on SSMSs, as a result of military personnel engaging in an ULSP. This chapter will provide a summary of the previous chapters, conclusions drawn from the statistical analysis, recommendations for future research.

A. SUMMARY

The ability to contain medical-care costs is found in two general strategies of cost-containment: supply-side and demand-side. The supply-side strategy focuses on the containment of costs associated with providing medical care by improving the efficiency and effectiveness of how health care is delivered and financed. The demand-side strategy focuses on containing those medical costs associated with the personal decisions made by the demander of medical care: the patient.

Upon examination of these two strategies, it was found that the majority of current health-care-reform initiatives focus on the supply-side strategies for cost reduction. However, it was also found that the majority of all illnesses and associated costs are preventable by a patient's own personal decisions to use, or not to use, certain ULSPs. Consequently, demand-side strategies that focus on changing

personal decisions to use an ULSP may be a useful form of health-care cost-containment.

The analytical determination of whether such demand-side strategies are legitimate cost-containment measures was based on a literature review and an application of a previously developed methodology. The literature review, through four progressive relationships, found that there are seven known lifestyle practices that affect a person's health status and a defined population's mortality rates. Further, this literature review found medical-care utilization and costs are associated with some of these seven lifestyle practices, in specific populations.

Drawing from these four relationships, the methodology was used to determine if fit-for-duty military personnel had a cost impact on SSMSs, as a result of engaging in the use of an ULSP. This methodology had four steps. The first step was to determine a statistical modeling strategy that could be used to isolate ULSPs that had a significant effect on a particular SSMS. The second step was to determine the probabilities of using a SSMS, provided the ULSP was significant, for an ULSP user and an ULSP non-user. The third step was to estimate the number of times a SSMS was used, on a per-person and DoD-wide basis, by those who used or did not use a significant ULSP. The fourth step was to estimate the total DoD cost impact that the significant ULSP had on its corresponding SSMS.

The results from these four steps identified ULSPs that had a cost impact on particular SSMSs.

B. CONCLUSIONS

The analysis done in this thesis allows for two conclusions to be made.

The first conclusion is that the use of specific ULSPs result in a cost impact on several SSMSs. While these cost impacts can be characterized as modest, they do indicate that fit-for-duty military personnel, who use specific ULSPs, are already beginning to impose additional medical-care cost on the several SSMSs.

The second conclusion is that for the first time, because of the cost impact results, there are established reference points for DoD to use in monitoring fluctuations in SSMS use associated with ULSPs among the active duty force.

C. RECOMMENDATIONS

As a result of the above conclusions, three areas of future research are available.

The first area of research that can be undertaken is to determine whether demand-side strategies, such as HP programs, are viable medical-care cost-containment measures. While this thesis found the cost impacts on several SSMSs, due to specific ULSPs, an examination of the monetary costs and benefits of HP programs was not done. As such, future

research will be needed to determine the cost-effectiveness of demand-side strategies such as HP programs.

The second area of research that can be done is to determine whether the established reference points are acceptable, in view of what DoD spends on HP programs? This question must be answered by DoD policy makers to determine how high, or low, these reference points should be. If the reference points are unacceptable then questions on how to change these reference points must be addressed.

The third area of research is to examine the short-term and long-term medical-care cost impacts that ULSPs impose on the federal government, including on the DoD (through the age of 65) and Medicare (after the age of 65). This type of research could be done in four stages, incorporating four different populations.

Using the results from this thesis as reference points, the first stage would be to repeat the study done here, in subsequent years, in order to analyze cost and utilization trends on the use of SSMSs, as a result of ULSPs. This type of study would provide beneficial short-term information for DoD health promotion policy makers as they define the amount of resources to be spent for a particular year.

The second stage would be to examine, through cohort analysis, the cost effects of ULSP usage, on SSMSs, as military personnel progress through their career. This type of study would be a more comprehensive approach in examining

the cost impacts placed on SSMSs, as a result of using ULSPs. Further, a cohort analysis would demonstrate the progression of changes in medical-care utilization and costs as personnel age in the military.

The third stage would be to examine the cost impact of ULSP usage on personnel who are past the age of their military retirement. Since military retirees still utilize DoD resources, through the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS), it is of great importance to know what the medical-care cost of ULSP users is on DoD, between the age of retirement to the age of 65. Further, this population would allow for an examination that begins to analyze the long-term utilization and cost impacts of using ULSPs.

Finally, the fourth stage would be to conduct a cost impact/ULSP study on those retirees who are over 65, and who are receiving their medical care from Medicare. At this time, military retirees, over the age of 65, no longer are allowed to use CHAMPUS. However, they do use the available Medicare services, which are financed by the federal government. While not part of the military health care system any longer, it is important to examine such a population to determine the long-term utilization and cost impacts of using ULSPs, that originated in the military, over an entire lifetime. By knowing such information, the military can respond to future costs impacts of ULSP usage through the tailoring of current

HP programs. Thereby, reducing medical-care expenditures, as a result of using ULSPs, not only for the military, but also for the nation.

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